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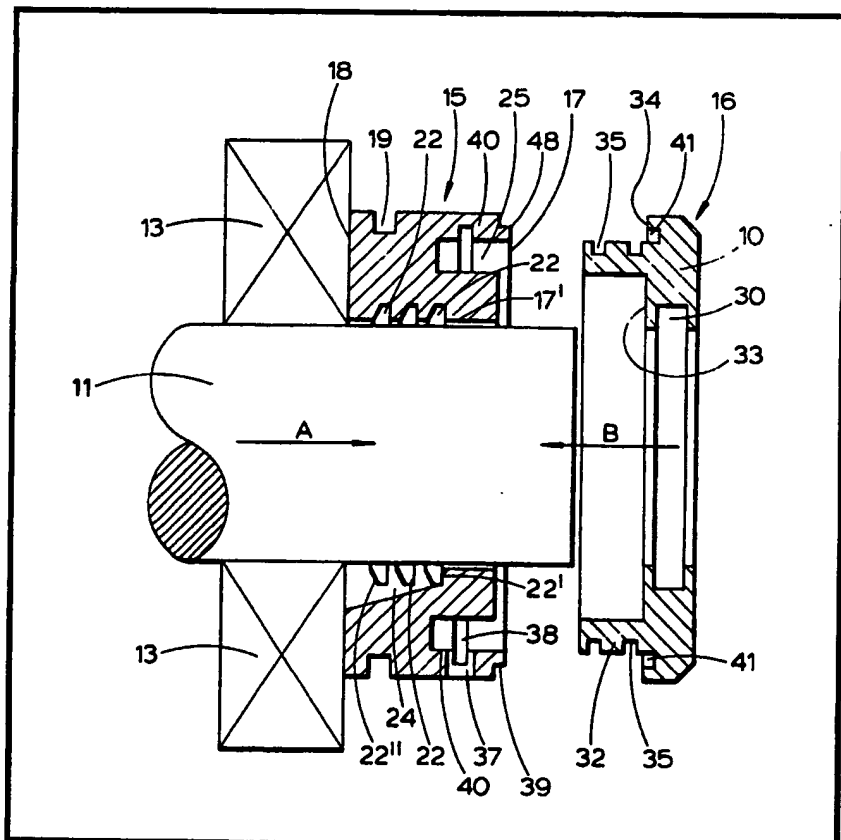
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(54) Sealing devices

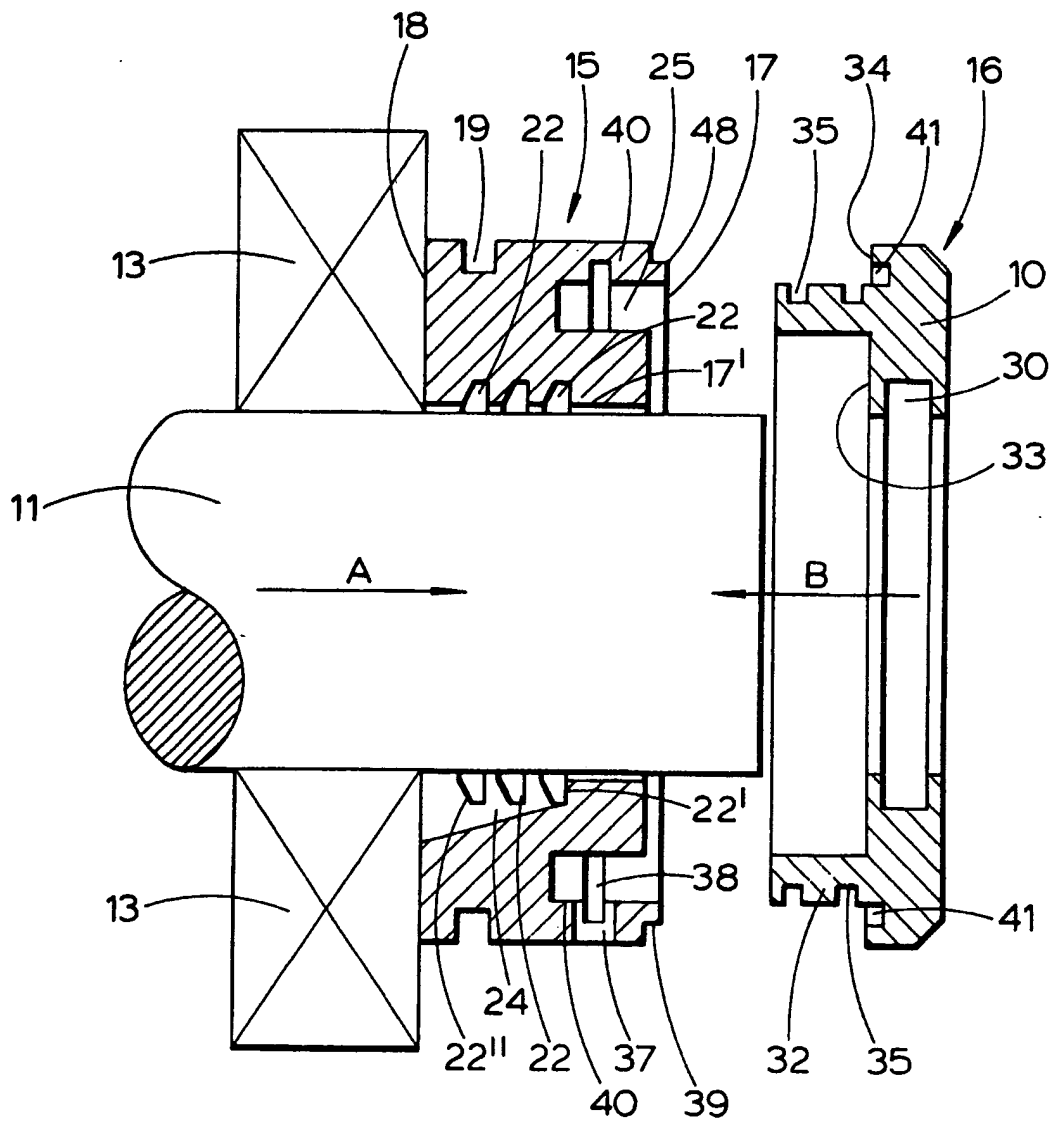
(57) A sealing device is composed of a pair of relatively-rotatable rings 15, 16 and is fitted to a shaft 11 rotatably supported by a bearing 13. One ring 15, which is intended to be stationary, has grooves, 22, 24 adjacent the shaft 11 which restrict the leakage of lubricant from the bearing 13. The other ring 16 rotates with the shaft 11 without frictional contact with the stationary ring 15. To prevent the ingress of contaminants from the outside, the ring 15 has a recess 25 receiving a main flange 32 of the ring 16 and the radially outer surfaces of the flange 32 and the recess 25 have grooves 35, 38 which trap and provide a passage for contaminant which escapes via an opening 37 in the stationary ring 15. A preliminary restriction pro-

vided by a further projection and recess 48,41 between the ring 15,16 radially outside the main flange and recess 25,32 inhibits the ingress of contaminants to the recess 25.



The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

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SPECIFICATION

Improvements in sealing devices

- 5 The present invention relates to sealing devices for use with rotating members, such as shafts.
- In general, there is a need in many industrial applications for a sealing device for the bearings of rotating shafts or the like. Such a device should ideally prevent lubricant from leaking into the surroundings and prevent foreign matter from passing from the surroundings into the bearing or bearings.
- 10 U.S. patent specification 4022479 describes and discloses one form of known sealing device.
- The present invention provides a sealing device in the form of a pair of complementary relatively-rotatable ring components, one of said ring components having a main axially-extending projection or flange and the other of said ring components having a main recess for receiving the main projection or flange as known per se. The main recess and flange may be plain, as shown in U.S. specification 4022479, but are preferably shaped or otherwise provided with means for restricting the passage of contaminant matter or fluid axially of the ring components. The other ring component has an opening communicating with the main recess which permits the escape of said matter or fluid which would otherwise tend to pass through the device. In accordance with the present invention, the ring components have a further inter-engageable projection and recess radially outwardly of the main recess and flange. This further projection and recess places a preliminary restriction on the passage of matter or fluid prior to the action of the main recess and flange. Grooves can be provided in the radially outermost facing surfaces of the main recess and flange to constitute the restriction means.
- 45 During use, the aforesaid one ring component may rotate with a rotary member or shaft while the other ring component remains stationary.
- One embodiment of the sealing device comprises first and second rings or ring components. The first ring has a main body, an axial flange and a recess radially outside the axial flange but conveniently closely adjacent thereto. The second ring has a main body with first and second opposite ends, an axial recess in the second end for receiving said flange of the first ring and a projection or flange radially outside the recess for reception by the recess of the first ring. The recess of the second ring has radially inner and outer walls and the flange of the first ring has corresponding radially inner and outer surfaces. At least one annular groove is provided in the outer surface of the flange of the first ring, at least one
- 65 annular groove is provided in the outer wall of

- the recess of the second ring, and an opening establishes communication between the exterior and said at least one groove in the outer wall of the recess of the second ring to permit the passage and escape of contaminant matter or fluid. The grooves and opening co-operate during use when the first and second rings rotate relatively to restrict the passage of matter or fluid axially between the rings by causing such matter or fluid to become forcefully expelled via the opening. The mating of the recess of the first ring and the projection of the second ring provides a preliminary seal initially restricting the passage of matter or fluid to the main recess and flange with the aforementioned grooves.
- The opening in the other or second ring component or ring can be a simple bore or slot, for example. However, it is not necessary to provide just one opening in the other or second ring component or ring for the expulsion or escape of fluid or matter and a plurality of such openings or holes can be provided, if desired.
- 90 The one or first ring component or ring having the main flange preferably locates a seal or O-ring on its inner surface for engagement with a rotational member or shaft. Similarly, the other or second ring component or ring with the main recess preferably locates a seal or O-ring on its outer surface for engagement with a housing in which the rotational member or shaft is supported for rotation by bearing means.
- 100 During operation, the preliminary seal and restriction means, as described above, serves to prevent matter or fluid from entering a shaft-supporting bearing means adjacent the device or from entering a housing containing the bearing means. Preferably, the other or second ring component or ring has further restriction means to prevent the leakage of lubricant from the bearing means. This further restriction means may comprise further
- 110 grooves at the interior or inner periphery of the other ring component arranged, for example, as described in U.S. Patent Specification 4022479.
- The invention also provides a shaft or similar rotatable member supported for rotation by bearing means in combination with a sealing device made in accordance with the foregoing.
- The invention may be understood more readily, and various other features of the invention may become apparent, from consideration of the following description.
- An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawing, which is a sectional exploded schematic side view of a sealing device made in accordance with the invention.
- As shown in the drawing, a rotatable member or shaft 11 is supported for rotation by a
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rolling-element bearing indicated diagrammatically by reference numeral 13. The bearing 13 is lubricated by any suitable means. The sealing device described hereinafter serves to prevent lubricant from escaping from the bearing 13 or otherwise and to prevent the ingress of extraneous foreign matter into the bearing 13.

The sealing device, as illustrated, is composed of a pair of complementary ring components or rings: namely, a first or inner ring 15 and a second or outer ring 16. The rings 15, 16 are designed to mate with one another and to fit over the shaft 11. The ring 15 is intended to remain stationary, while the ring 16 is intended to rotate with the shaft 11.

The inner ring 15 has first and second axial end faces 17, 18; the latter face 18 locating against the stationary race of the bearing 13. A regular annular radial groove 19 is provided in the exterior periphery of the ring 15 adjacent the end face 18. This groove 19 receives a seal in the form of an O-ring (not shown) which can seat on a convenient location, e.g., of a housing (not shown) containing the bearing 13. The ring 15 has three annular radial grooves 22 in its internal periphery. An axial groove 24 is also provided in the internal periphery of the ring 15 and communicates with all three grooves 22. The groove 24 tapers in depth to decrease in a direction towards the ring 16. Each of the grooves 22 also tapers in depth, as shown, and has a radial side wall or shoulder 22' nearest the ring 16 and an inclined surface 22'' leading to the wall 22'.

A deep annular axially extending recess 25 is provided in the end face 17 of the ring 15. An opening in the form of a bore 37 extends radially outwards of the recess 25 to establish communication between the recess 25 and the exterior periphery of the ring 15, conveniently via an annular groove 38 in the peripherally outermost wall 40 of the recess 25. A cut-out or recess 39 is formed at the juncture between the end face 17 and the exterior periphery of the ring 15 and the end portion of the ring 15 defining the inner wall of the recess 25 and the inner periphery is relieved at its axial end face 17' relative to the end face 17. An axial projection 48 is thus formed.

The other ring 16 has a main body 10 with a reduced offset annular flange 32 at its inner axial end. This flange 32 is received by the recess 25 of the ring 15. The overall size of the flange 32 is less than that of the recess 25 to provide adequate clearance therebetween. An annular groove 30 in the inner periphery of the main body 10 of the ring 16 receives a seal in the form of an O-ring (not shown) which frictionally engages the shaft 11. Thus, the ring 16 can be fitted to the shaft 11 for rotation. If desired, however, the ring 16 can be clamped or keyed to the shaft

11. The main body 10 of the ring 16 has a radial inner face 33, which lies closely adjacent the end face 17' of the ring 15. The main body 10 of the ring 16 also has a radial outer face 34 which is provided with an annular recess 41 adjacent the flange 32. The recess 41 serves to receive the projection 48 of the ring 15. The flange 32 of the ring 16 has a pair of radial regular annular grooves 35 in its outer periphery. Preferably, the outer periphery of the flange 32 is then provided with a pair of diametrically-opposed recesses or depressions (not shown) each of which interconnects the grooves 35.

During operation, the rings 15, 16 are mated together with the main flange 32 snugly received in the main recess 25 and the projection 48, likewise, snugly received in the recess 41. As the shaft 11 rotates there is relative rotation between the rings 15, 16 but there is no frictional contact between the rings 15, 16. The sealing device, i.e., the rings 15, 16, act as a two-way seal, as mentioned previously. The shaft 11 rotates within the internal periphery of the ring 15 and any lubricant tending to leak along the shaft 11 in the direction of arrow A is collected by the grooves 22 and is directed into the groove 24 which traps and guides the lubricant back in the reverse direction to arrow A. The groove 24 preferably lies at the lower part of the ring 15, as shown, so that the lubricant is also subjected to gravity force. Conversely, any tendency for extraneous fluid or matter to pass the sealing device in the direction of arrow B is opposed by inter alia the flange 32 and the recess 25. Primarily, the grooves 35 and the communicating depressions tend to displace matter with the aid of centrifugal force to the drainage opening 37, via the groove 38. If desired, a number of spaced drainage openings 37 can be provided. The inter-engagement of the projection 48 and the recess 41 enhances the latter-mentioned sealing action by forming a simple preliminary seal or restriction on the path taken by extraneous matter to reach the main restriction or trap (32, 25, 37).

Instead of utilizing a single groove 38 in the outer wall 40 of the recess 25, it is possible to provide several grooves 38 in the wall 40. These plural grooves 38 may be regular and of the same depth, or of varying depth as one to another or irregular in the sense of having non-radial side walls which tapers towards the ring 16 in the direction of the axis of the ring 15.

In another modified form of sealing device also constructed in accordance with the invention, a single groove is provided in the outer periphery of the flange 32 of the ring 16, instead of the pair of grooves 35, as illustrated. This single groove aligns with the single groove 38 in the peripherally outermost wall 40 of the recess 25 of the ring 16 when

the rings 15, 16 are mated together. Instead of having parallel side walls, the groove 38 is channelled with non-parallel side walls to progressively decrease in width radially outwards of the wall 40. In this modified device, the bore 37 in the ring 15 is replaced by an arcuate slot.

CLAIMS

1. A sealing device in the form of a pair of complementary relatively-rotatable ring components, one of said ring components having a main axially-extending projection or flange and the other of said ring components having a main recess for receiving said main projection or flange and an opening communicating with the recess which permits the passage and escape of contaminant matter or fluid, wherein the ring components have a further inter-engageable projection and recess radially outwardly of the main recess and flange.
2. A device according to claim 1, wherein the radially outermost facing surfaces of the main recess and flange have co-operating grooves which serve to restrict the passage of the contaminant matter or fluid.
3. A sealing device comprising first and second rings or ring components, the first ring having a main body, an axial flange and a recess radially outside the axial flange, the second ring having a main body with first and second opposite ends, an axial recess in the second end for receiving said flange of the first ring and a projection or flange radially outside the recess for reception by the recess of the first ring; wherein at least one annular groove is provided in the outer surface of the flange of the first ring, at least one annular groove is provided in the outer wall of the recess of the second ring and an opening establishes communication between the exterior and said at least one groove in the outer wall of the recess of the second ring to permit the passage and escape of contaminant matter or fluid.
4. A sealing device according to any one of claims 1 to 3, wherein said one or first ring component or ring locates a seal or O-ring on its inner surface which serves to engage with a rotatable member or shaft supported for rotation by bearing means.
5. A sealing device according to claim 4, wherein the other or second ring component or ring locates a seal or O-ring on its outer surface for engagement with a housing in which the bearing means is housed.
6. A sealing device according to claim 4 or 5, wherein the other or second ring component or ring has grooves at its inner periphery to prevent leakage of lubricant from the bearing means.
7. A sealing device substantially as described with reference to, and as illustrated in the drawings accompanying U.K. patent application 39421/78.

8. A shaft or similar rotatable member supported for rotation by bearing means in combination with a sealing device according to any one of the preceding claims.

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